THE NATIONAL SCIENCE EDUCATION ACTS OF 2000

(To be introduced by Vernon Ehlers and others)

Introduction

Our science and technology enterprise has the ultimate goal of improving the lives, health, and freedom of all peoples. Our country's scientific strength is at the heart of our recent economic boom and undergirds our national defense. America depends on science.

However, a preponderance of evidence indicates that our schools aren't preparing our students adequately for the knowledge-based, technologically rich America of today and tomorrow. Without a strong supply of scientists and engineers, of technologically competent workers, and of scientifically literate consumers and voters, the future well being of America is in jeopardy.

American student performance in math and science is not on par with students in other countries. Recent assessments of the progress of student performance in various subject areas, including Science, Math, Engineering, and Technology education, have concluded that in some age groups the grasp of science and math by U.S. students is less than that of their international peers. These findings prove that our twelfth grade students are far from the goals set by the Bush Administration and 50 State Governors of being first in the world in math and science by the year 2000.

It also is notable that over half of our graduate students in science and engineering are foreign-born. The attraction of these students to American Ph.D. and post-doctoral level programs highlights a situation with serious long-term implications for the U.S. The apparent lack of interest or preparation many of our own students seem to have for careers in science or engineering will limit the innovation that propels the economic growth that creates prosperity. Indeed, some of the blame for this situation can be placed on a K-12 educational system that does not sufficiently excite or educate students in math or science and discourages further pursuit of these subject areas.

The short-term ramifications of inadequate preparation and lack of interest in science, math, engineering and technology are already visible. There are hundreds of thousands of technology-related jobs that are unfilled in the U.S. – despite an average salary (in 1996) of $46,000, more than fifty percent more than the average wage of $28,000.[1] In 1999 American companies, unable to continue without an adequate domestic pool of potential employees, implored upon Congress to increase the statutory cap on the number of visas for foreign, skilled workers. Congress responded by raising the limit for three years. This action, however, is not meeting industry's need: the cap for 2000 was already reached in March 2000.

In order to reverse this trend of the U.S. economy outpacing the supply and qualifications of domestic skilled workers, we must continue to nurture all citizens so they may develop a solid educational foundation. We must be able to broadly train people so that American companies can fill the needed positions with qualified and capable U.S. citizens. If we hope to remain the

[1] (U.S. Department of Commerce)

world's leading economy, we must be able to continue to rely upon a talented and versatile workforce.

Moreover, cutting-edge skills are no longer required only of scientists, mathematicians, engineers and the like. There is a "real world" impetus for learning science and mathematics. Many of today's jobs require more than a basic level of technical competence. It is well known that many of the higher paid entry-level jobs are in the computer and related technology fields. But in addition to the ever-increasing demand for jobs that require specialized knowledge, virtually every job now demands some level of technical competence and problem solving skills. For example, in the past typing, basic math and an understanding of measurements were sufficient skills to work in offices, retail stores, and factories, respectively. These same positions now require word processing and spreadsheet manipulation, general computer skills, and mastery of complex machinery, which, again, is often computer-controlled. For many Americans, these skills are no longer part of "on-the-job training," but rather prerequisites for entry-level positions.

It also is clear that the long-term implications still are to come. Over half of our economic growth today can be attributed directly to research and development in science and technology. Notably, the technological sector of our economy, which is driving our current economic boom, was fueled by scientific discoveries. Our ability to maintain this economic growth will be determined largely by our Nation's intellectual capital. The only necessary and sufficient means to developing this resource is education.

In addition to ensuring the conditions for economic prosperity, quality science, math, engineering and technology education increasingly is becoming necessary for day-to-day life. For citizens to thrive in 21st Century America, a well-rounded and deep literacy in scientific ideas and processes will be essential. Our society is now based upon technology and information, and in this new century the most valuable commodity is knowledge. As communications technologies rapidly change the way in which we interact with one another, the key to success is no longer acquiring information but rather analyzing and processing that information. To be wise consumers, intelligent voters, and coveted employees our citizens will need to know the skills of science—collecting data, evaluating evidence, finding trends, designing experiments—more than ever. The demand for quality science and math education is increasing.

Context for Solutions

We have much to be proud of in our Nation's educational systems, but we always ought to be seeking to address our weaknesses and to improve our performance.

In the context laid out above, education programs must provide unsurpassed science, math, engineering and technology instruction to every K-12 student. New methods of teaching math and science should be integrated into curricula. Science and math lessons should include more than just memorizing a collection of facts, theories, and results. Science classes should focus on a process of inquiry built upon observations and data that lead to a way of knowing and explaining in logically derived concepts and theories. Students should learn science primarily by doing science; the lessons ought to reflect the scientific process, be object-oriented, experiment-centered, and concept-based. Auspiciously, pedagogical techniques that take advantage of this

model can tap into children's curious and inquisitive nature and develop an excitement for these subjects.

To ensure that students are provided the best possible learning environment, studies are revealing that the most important factor of educational improvement efforts, especially those in science, math, engineering and technology, is enthusiastic and well-prepared teachers. When integrating the needs of learners into the context of the emerging needs of the American workplace and society, the truth of the observation "teaching is the essential profession, the one that makes all other professions possible" is obvious.

Teachers provide the essential connection between students and the content they are learning. Thus, high quality teachers must be identified, recruited, and retained in every school district throughout the Nation. K-12 science, mathematics, engineering or technology teachers should be respected by their peers, rewarded financially and intellectually, and have sufficient opportunities for advancement. In exchange, we must expect that all teachers are knowledgeable of their content area, curriculum, up-to-date research in teaching and learning, and techniques that can be used to connect information to the students in their classrooms. Therefore, teachers, just like other professionals, should be offered incentives to remain in the classroom and improve their practice.

However, most school administrators, government education officers, and parents now acknowledge that the causes of mediocrity (and in some cases failure) in our school systems are not the result of a single flaw. Many educational practices, such as teaching methods, teacher training, school organization, and administration processes, are interconnected. Thus, reform efforts must be broad-based and comprehensive.

K-12 education in the United States is primarily the charge of local and State governments. The Federal Government plays a role in certain efforts, especially as an impetus to change. Most State reform initiatives begun in the past several years have adopted the strategy of improving all aspects of educational systems and do take advantage of federal incentives toward change in particular directions. Thus, although State efforts are tailored to meet the needs and preferences of the individual locality, there are threads of commonality inspired by federal actions.

Among the States, the successful reform efforts all involve multiple stakeholders including governments, school administrators, teachers, community members and parents. There is an expectation of responsibility among these partners and of the students that is unprecedented. And such accountability appears to be working.

From these local demonstrations of success, what role should the Federal Government play in encouraging such progress? In furthering the principle of a solid commitment to high student academic achievement the Federal Government can serve as a resource to State and local governments without superseding local efforts. However, all partners to education reform must incorporate the dual tenets of quality teaching and state-of-the-art educational programs into education reform, especially in the core areas of science, math, engineering and technology, as mastery of these disciplines will continue to propel the economy and better the lives of all individuals.